PATENT SPECIFICATION

DRAWINGS ATTACHED

957,487

957,487

Date of Application and filing Complete Specification Sept. 11, 1961.
No. 32537/62.
Application made in Denmark (No. 3628) on Sept. 13, 1960
Complete Specification Published May 6, 1964.

Index at acceptance:—B8 P(8B, 8C1A1, 8K); B3 A83; B3 R14A; B5 D10B2X; B8 C(1A2, 1C2B, 10D3B, 10D3D, 10P1C, 10P1D, 15A, 15E2, 25D, 29C)

International Classification:—B 65 d (B 23 k, B 23 p, B 31 b, B 65 b)

COMPLETE SPECIFICATION

Improvements in or relating to Metal Cartons

ERRATUM

SPECIFICATION No. 957,487

Page 1, Application date, *for* "32537/62"
read "32537/61"

THE PATENT OFFICE
12th June 1964

pervious to light, so that the goods can be kept in storage for a prolonged time without risk of spoiling. A carton for retailing such goods in portions meeting all the said requirements has been lacking from the market hitherto.

For packaging purposes it is known to use containers of metal in the form of tins. Such containers, however, require complex apparatus for their production and are therefore as a rule supplied by specialized factories. It is true that such containers are capable of sterilization as well as impervious to light, but in addition to a high cost of production substantial expenses are incurred in transporting the empty tins from the tin factory to the place where they are to be filled, e.g. a dairy. Moreover, as a rule such containers cannot be closed once they have been opened, unless they are provided with cost-increasing screw caps or the like devices.

It has also been proposed to produce metal containers with a tubular container portion sterilized by heating. Besides, the price per litre for a container of cardboard or plastic foil is too high.

In cylindrically-shaped tins as well as in containers of cardboard or plastic foil, the material blanks of which the containers are made are joined by folding with the use of a caoutchouc packing, which is a rather expensive method, or else soldering means or adhesives are used. Such means may, however, be detrimental to the article contained in the vessels and affect its keeping qualities. It is true that this drawback does not pertain to glass bottle packings, but like tins this packing is rather expensive, when it is to be used only once. Therefore, it is also the normal procedure to return the glass bottles after use, whereupon they are cleaned and used again.

Thus, the known containers are too expensive as packs to be used only once for low-priced consumer goods, among other reasons partly because they must be manu-

PATENT SPECIFICATION
DRAWINGS ATTACHED

957,487

957,487

Date of Application and filing Complete Specification Sept. 11, 1961.
No. 32537/62.
Application made in Denmark (No. 3628) on Sept. 13, 1960
Complete Specification Published May 6, 1964.

Index at acceptance:—B8 P(8B, 8C1A1, 8K); B3 A83; B3 R14A; B5 D10B2X; B8 C(1A2, 1C2B, 10D3B, 10D3D, 10P1C, 10P1D, 15A, 15E2, 25D, 29C)

International Classification:—B 65 d (B 23 k, B 23 p, B 31 b, B 65 b)

COMPLETE SPECIFICATION

Improvements in or relating to Metal Cartons

We, PETER SKJØDE KNUDSEN, a Danish Subject, of 5, Riis Toft, Kolding, Denmark, and ERIK JOHANSEN, a Danish Subject, of 21, Skolebakken, Strandhuse per Kolding, Denmark, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to cartons of metal foil and particularly to a method of producing such a container for liquid food or stimulants, for example, and to apparatus for carrying the method into effect.

A demand exists for cartons for retailing in portions chiefly liquid and particularly sterilized food or stimulants, e.g. sterilized milk; the price of which cartons must be so low that cheap consumer goods such as milk can bear the cost of the packaging. The cartons must also be capable of sterilization and impervious to light, so that the goods can be kept in storage for a prolonged time without risk of spoiling. A carton for retailing such goods in portions meeting all the said requirements has been lacking from the market hitherto.

For packaging purposes it is known to use containers of metal in the form of tins. Such containers, however, require complex apparatus for their production and are therefore as a rule supplied by specialized factories. It is true that such containers are capable of sterilization as well as impervious to light, but in addition to a high cost of production substantial expenses are incurred in transporting the empty tins from the tin factory to the place where they are to be filled, e.g. a dairy. Moreover, as a rule such containers cannot be closed once they have been opened, unless they are provided with cost-increasing screw caps or the like devices.

It has also been proposed to produce metal containers with a tubular container portion with a bottom at one end of the said portion, whereas for closing purposes the opposite end of the container portion is squeezed together, whereupon the edge portion thus flattened is folded, making a special closing device superflous. The containers are produced seamless by deep drawing. However, there are limits to the size in which such a container can be made without unduly increasing the cost of the machines for the production of the containers, and also the physical properties of the material will set limits to the size and shape of the containers. Consequently, the said containers are used exclusively for small quantities, e.g. for cream in packs containing 50 grammes.

It is also known for packing purposes to use containers of cardboard or plastic foil which is folded and joined. In the case of cardboard the container is also paraffin-coated. However, as a consequence thereof such packs cannot be sterilized by heating. Besides, the price per litre for a container of cardboard or plastic foil is too high.

In cylindrically-shaped tins as well as in containers of cardboard or plastic foil, the material blanks of which the containers are made are joined by folding with the use of a caoutchouc packing, which is a rather expensive method, or else soldering means or adhesives are used. Such means may, however, be detrimental to the article contained in the vessels and affect its keeping qualities. It is true that this drawback does not pertain to glass bottle packings, but like tins this packing is rather expensive, when it is to be used only once. Therefore, it is also the normal procedure to return the glass bottles after use, whereupon they are cleaned and used again.

Thus, the known containers are too expensive as packs to be used only once for low-priced consumer goods, among other reasons partly because they must be manu-

factured in special factories, and partly because they are unsuitable for prolonged storage especially of perishable goods such as milk. The object of the invention is to indicate a low-cost method of production of cartons of metal suitable also as packs to be used only once, wherein also perishable goods such as sterilized milk can be stored under sterile conditions for a prolonged time without risk of spoiling.

The invention relates to a method as well as to an apparatus for producing a metal cartons, which meet these requirements. The method is based on the production of a metal carton capable of sterilization and impervious to light, especially for milk or other liquid food or stimulants, and according to the invention the the said object is attained by forming the carton of thin metal sheet, e.g. metal foil, by folding and joining the metal sheet with the use of ultrasonic welding.

The invention is thus based on the recognition that under certain characteristic conditions it will be possible to produce cartons of material which is capable of sterilization and impervious to light, without any necessity for the said drawbacks of the known pack to arise. For if the carton is produced in the way indicated by the invention the forming of the carton will be possible by means of a single space-saving apparatus, and can therefore be made in the place where the carton is to be used, e.g. in connection with a milk dispensing device in a dairy. Practically speaking the transport costs for empty packing materials are eliminated, as the carton material, e.g. aluminium sheet or aluminium foil, is transported to the dairy in the form of rolls. Furthermore, the method permits the production of a resistant carton, which consists of no other material than this metal sheet itself, and which is therefore free of sources of contagion or other drawbacks such as disagreeable taste or toxic effects originating from soldering means or adhesives. The reason is that ultrasonic welding is so performed that a press plunger with a point shaped e.g. as a spherical segment is pressed against the place where the metal sheets to be joined overlap, in a direction transversely of the sheet plane. With the use of ultrasonic energy the plunger is set in a swing motion parallel with the sheet plane, and by cooperation between the said pressure and the oscillatory energy the sheets are joined by cold welding along the welded seam. Also perishable goods such as sterilized milk can be stored in such a carton for a long time without risk of being spoilt. Moreover, different sizes of the carton can be produced without difficulty, i.e. even litre sizes and more, and also no difficulties are encountered in imparting a suitable shape to the packing so that a number of containers can be packed in a space-saving way, e.g. in a collecting box.

As a consequence of the said advantages the method according to the invention affords possibilities of producing a novel and advantageous technical product in the form of a carton which is capable of sterilization, resistant, cheap, and suited to be used only once.

According to the invention it is expedient for carrying the method into effect that a sheet blank for the carton is folded on a mandrel constituting the counter member for the ultrasonic welding, whereby a predetermined shape is imparted to the blank. In this way one and the same member, i.e. the mandrel, will be capable of serving the dual purpose of shaping and welding, whereby a simplification of the manufacturing process is achieved.

According to the invention the method further provides that a sheet blank for a carton is folded and joined into a tube of substantially rectangular cross section, and that in both ends of the tube end closures are produced by uniform folding operations, the end portions of one pair of opposite tube walls being folded so that the end portions remain parallel and opposite to one another, with the interposition only of a double thickness of carresponding end portions of a second pair of opposite tube walls, the end-portion being joined together by ultrasonic welding, and the said end portions of one end of the tube thereafter being flattened to form a flat bottom. By the use of cartons with rectangular transverse section one requirement has been met for collecting the maximum number of containers in a transport box, and the production of uniform end closures at both ends of the container affords the possibility of designing an apparatus for the production of the cartons according to one principle of end-closure, so that a simple and well arranged compact construction is achieved.

Furthermore, according to the invention it is particularly expedient that the tube has a rectangular cross-section, and that the welded seam along which the sheet blank is joined to form a tube is disposed substantially along the longitudinal centre line of one of the wider sides. The result of adopting this principle of design is that, during folding the folded centre portions of the narrow tube walls do not meet but that a space is left between the said folded centre portions, whereby room is afforded for the flattening of the material during welding along the welded seam of the end-closure, which will take place when changing over from the welding of four layers of material to the welding of two layers of material, as will be explained in the following. Likewise, space will have been provided for placing the longitudinal welded seam of the tube between the said end portions which have been folded against one another.

The application of the first mentioned folding technique also to the forming of the carton

bottom will furthermore afford the possibility of producing a container that will stand safely, because according to the invention the freely protruding length of the end portions of tube walls last bent against one another can be chosen so large that the lengths of both said end portions together total more than the straight distance between the particular walls of the tube itself. When the end-closure is flattened, an outward curvature of the carton bottom at both sides of the joining seam will be obtainable on account of the surplus material, so that two equally spaced ridges are provided, which are capable of lifting the carton free of the support, and between which runs the welded seam joining the end portions of tube walls folded against one another.

For the production of a carton with a tubular container portion and two end covers it is expedient according to the invention that the tubular portion is produced from one sheet blank, which is folded and joined by means of an ultrasonic welding unit, whereas the end covers are produced from a separate sheet blank and attached to the container portion by means of one or more other ultrasonic welding units. The application of this procedure will ensure a rapidly progressing production of the containers, the container portion and the end covers being produced separately and thereupon joined.

The invention also relates to an apparatus for the production of cartons of metal foil and the like. According to the invention the apparatus is provided with members for transporting and folding metal sheet and with one or more ultrasonic welding units and members for the relative movement between sheet blank and welding unit. An apparatus thus conceived will permit a continuously progressing production of the desired cartons from metal sheet stored in rolls.

For the production of containers with uniform folding of end closures in both ends of the carton, the apparatus according to the invention may be so designed that it comprises two pairs of equally spaced end-closure folding and welding units, and that a press plunger for flattening the bottom of the carton is disposed between the two said units. This apparatus will permit continuous production, filling, and closing of a carton, because between the press plunger and the second end-cover folding and welding unit a dispensing device for the medium, with which the container is to be filled, can be provided.

The invention will be more clearly understood from the following detailed description of preferred embodiments thereof which is made, by way of example, with reference to the accompanying drawings, in which:—

Fig. 1 shows schematically an apparatus according to the invention for producing a carton of metal sheet,

Figs. 2 and 3 are transverse sections through the sheet in different stages of the forming of the container,

Fig. 4 shows on a larger scale one end of a tubular carton,

Fig. 5 shows the same end in the process of a folding operation,

Fig. 6 shows the same end closed by ultrasonic welding,

Fig. 7 shows the same end flattened out to form a carton bottom,

Fig. 8 is a transverse section on line VI—VI in Fig. 7, and

Fig. 9 is another form of end cover for the carton,

As shown in Fig. 1 metal sheet 10 is passed from a storage roll 12 to the foremost section 14 of a shaping mandrel having sections 14, 16, 18. Above the front end of the section 14 of the mandrel a pair of scissors 20 is provided. Above the mandrel there is provided a feeding mechanism 22 for metal sheet, consisting of two pairs of rollers 24 and 26, around each of which an endless band 28, and 30, respectively, has been passed. A rod 36 is attached to said bands by means of arms 32 and 34, respectively, the rod 36 extending in the longitudinal direction of the mandrel, and being provided with downwardly protruding gripping fingers 38. To the side of the mandrel section 16 folding members 40 are provided, and to the side of the left-hand part of the mandrel section 18 there is provided further folding members 42. To the right of the folding members 42 at the side of the mandrel section 18 there is provided a welding roller 44, which is connected to a source of ultrasonic energy.

To the right of the mandrel sections 14, 16, 18, as seen in Fig. 1, there is provided a four-mandrel revolving head 46, whose horizontal axis of rotation intersects the central longitudinal axis of the folding mandrel at right angles. The mandrels of the revolving head have the same cross section as section 18 of the folding mandrel. Above the revolving head 46 there are provided two folding members 48 and 50, which can be moved towards one another, and a pair of welding rollers 52, which are connected to a source of ultrasonic energy. To the right of the revolving head 46 as seen in Fig. 1 there is provided a press plunger 54 with a central ridge 56.

Below the revolving head a conveyor belt 58 is provided. A dispensing device for e.g. sterilized milk is denoted with the numeral 60. To the left of the tapping place 60 there are provided another folding member 62 and welding rollers 64, which are connected with a source of ultrasonic energy.

The directions in which the individual members move are shown by means of arrows.

The apparatus operates as follows:

From the storage roll 12 metal sheet is fed towards the mandrel section 14. When a measured length of metal sheet has arrived, it

is cut off by means of the scissors 20. The measured length of sheet is thereupon pushed onto the mandrel section 16 by means of the feeding mechanism 22, the bar 36 of which, being mounted on the bands 28 and 30 performs an essentially elliptical motion, the left-hand gripping finger 38 of the mechanism, after having completed its return stroke, engages the piece of sheet on the mandrel section 14 and passes the piece to the section 16. Here the sheet is bent to the shape shown in Fig. 2 by means of the folding members 40, which describe a downward and inward movement to fold the portions of the blank projecting beyond the upper surface of the mandrel section 16 downwards against the vertical sides of the mandrel section 16. Thereupon the bent piece of sheet is displaced by means of frictional contact with the second gripping finger 38 of the feeding mechanism 22 to the left-hand end of the mandrel section 18, where the sheet is bent by means of the folding members 42 into the tubular shape with rectangular cross section shown in Fig. 3. While the piece of sheet thus bent continues to be displaced to the right, the edges of the foil facing one another are welded together by means of the welding roller 44, a welded seam A being produced, see Fig. 3. The tube thus produced is moved by the right-hand finger 38 of the feeding mechanism 22 and fitted over a mandrel on the revolving head 46, which extending in continuation of the folding mandrel sections 14, 16, 18 allows free passage of the tube. The dimensional relations between the lengths of the tube and the mandrel are so arranged that one end portion of the tube stands clear of the mandrel see Fig. 1. The revolving head 46 is rotated, so that the said mandrel will stand upright below the folding members 48 and 50.

Following this, the folding members 48 and 50 are moved towards one another, whereby the walls of the said end portion of the tube are folded against one another, cf. Figs. 4 and 5, the folding lines being indicated in Fig. 4 in dotted line. By means of the welding rollers 52 the free edges of the walls are welded together, a welded seam B being produced. Furthermore, the tube blank is so dimensioned that the measurement C is suitably longer than the measurement D, so as to produce a suitable distance between the ends of the inward bends E and F, cf. Fig. 5, of the lateral carton walls facing one another. In Fig. 6 this distance is indicated with the letter G. It will also be seen from Fig. 6 that the welded seam A is positioned between the said inward bends.

After folding and welding of one end portion of the tube the revolving head is again rotated so that the free end of the mandrel opposes the press plunger 54. This plunger is now moved towards the mandrel, the ridge 56 coinciding with the welded seam B, whereby the end-closure is flattened into a carton bottom. The dimension H of the end-closure, see Fig. 6, must be not less than D/2. When H is equal to D/2 the bottom will be plane. As shown, however, it is expedient that H be made somewhat longer than D/2, because as a consequence of a surplus of material an outward curvature of the bottom material, as shown in Figs. 7 and 8, will take place during the advance of the press plunger 54. Thereby the container will be able to stand firmly on the ridges J and K in proximity to the longer sides of the cross section of the carton, whereas the welded seam B is hidden between the ridges.

Now the open carton thus formed is removed after continued rotation of the revolving head 46 from the mandrel and deposited on the conveyor belt 58, by means of which the carton is moved past the disposing device 60 and filled e.g. with sterilized milk. The carton is thereupon closed by means of the folding member 62 and the welding rollers 64 at the other end portion in a manner similar to the one shown in Figs. 4—6, and the filled and closed carton leaves the conveyor belt 58 to the left.

Also the production of cartons having a shape different from the one described in the foregoing will be within the scope of the invention. Fig. 9 shows a carton produced of the same material as described, but the design of the end cover of one end of the container deviates from an example described heretofore, one end portion of the carton being flattened in a manner similar to that of the bottom end of a collapsible tube, whereafter, the free edges of the end portion are welded together by ultrasonic welding along a welded seam L.

The carton according to Fig. 9 can also be provided with a bottom in accordance with Figs. 7 and 8.

WHAT WE CLAIM IS:—

1. A method of producing a metal carton capable of sterilization and impervious to light, especially for milk or other liquid food or stimulants, wherein the carton is formed of thin metal sheet, e.g. metal foil, by folding and joining the metal sheet with the use of ultrasonic welding.

2. A method according to Claim 1, characterized in that the sheet blank for the carton is folded on a mandrel constituting the counter member for the ultrasonic welding, whereby a predetermined shape is imparted to the blank.

3. A method according to Claim 1 or 2, characterized in that a sheet blank for a container is folded and joined into a tube of substantially rectangular cross section, and that in both ends of the tube end closures are produced by uniform folding operations, the end portions of one pair of opposite tube walls to one another being folded so that the end portions remain parallel and opposite to one

another with the interposition only of a double thickness of the corresponding end portions of a second pair of opposite tube walls, the end portions being joined together by ultrasonic welding, and the said end portions of one end of the tube thereafter being flattened to form a flat bottom.

4. A method according to Claim 3, characterized in that the tube is shaped having a rectangular cross-section and that the welded seam along which the blank is joined to form a tube is disposed substantially longitudinally of the centre line of one of the wide sides of the rectangle.

5. A method according to Claim 3, characterized in that the freely protruding length of the end portions of tube walls last bent against one another is chosen so large that the lengths of both these end portions together total than the straight distance between the particular walls of the tube itself.

6. A method according to Claim 1 or 2 for producing a carton with tubular portion and two end covers, characterized in that the tubular portion is produced from one sheet blank, which is folded and joined by means of an ultrasonic welding unit, whereas the end covers are each produced from a separate sheet blank and attached to the tubular portion by means of one or more ultrasonic welding units.

7. Apparatus for producing cartons of metal foil or the like to carry the method according to any of the preceding Claims into effect, characterized in that the apparatus is provided with members for transporting and folding metal sheet as well as with one or more ultrasonic welding units, and with members for the relative movement between sheet blank and welding unit, one past the other.

8. Apparatus according to Claim 7 to carry the method according to Claims 3, 4 or 5 into effect, characterized in that the apparatus comprises two pairs of equally spaced endclosure folding and welding units, and that a press plunger for flattening the bottom of the carton is provided between the said two units.

9. A carton capable of sterilization and impervious to light especially for milk or other liquid food or stimultants, characterized in that the carton is produced of metal sheet or metal foil capable of folding, and joined by means of ultrasonic welding.

10. A method of producing a metal carton from this metal sheet substantially as hereinbefore described with reference to the accompanying drawings.

11. Apparatus substantially as hereinbefore described with reference to the accompanying drawings for manufacturing a metal carton from thin metal sheet.

12. A metal carton substantially as hereinbefore described with reference to the accompanying drawings.

13. A metal carton manufactured by the method claimed in any one of claims 1 to 6 and 10.

PAGE, WHITE & FARRER,
Chartered Patent Agents,
27, Chancery Lane, London, W.C.2.
Agents for the Applicants.

Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1964.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

Fig. 1

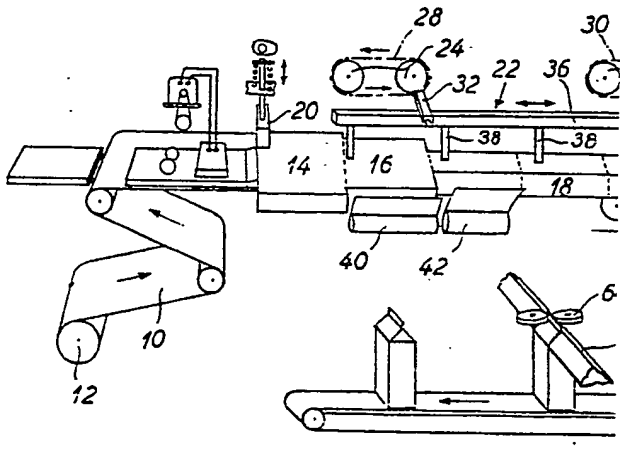


Fig. 2

957487 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig. 1

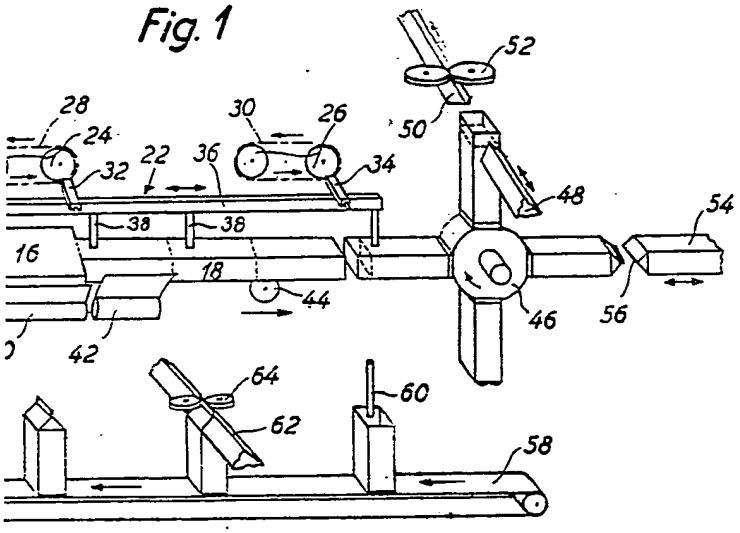
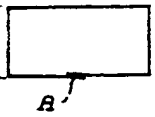


Fig. 3



957487 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

Fig. 1

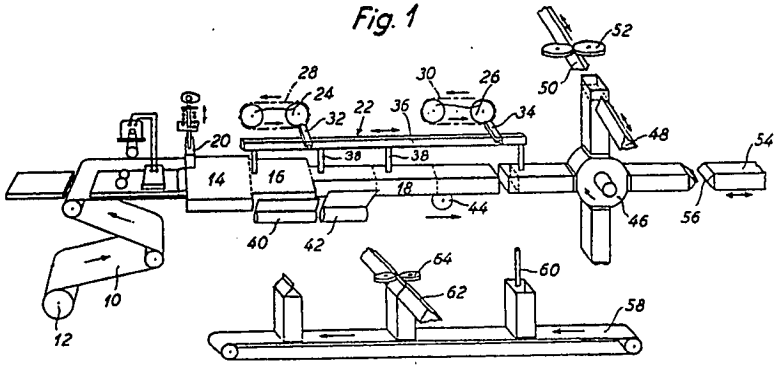
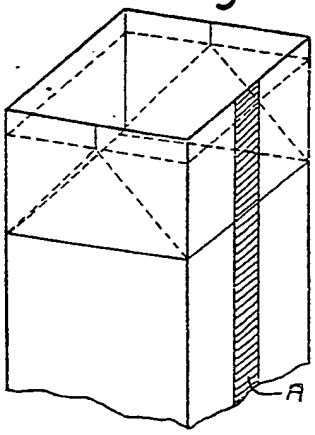


Fig. 2

Fig. 3

B

Fig. 4



Fig

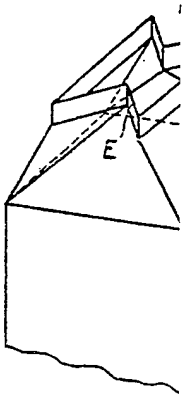
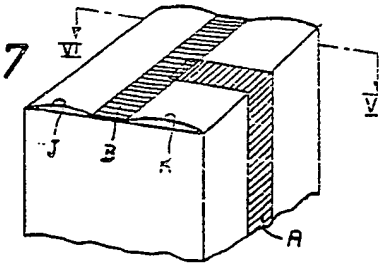


Fig. 7



957487 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheets 2 & 3

Fig. 5

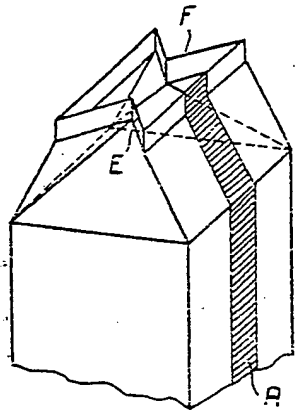


Fig. 6

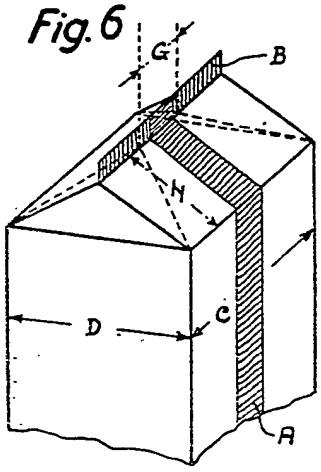
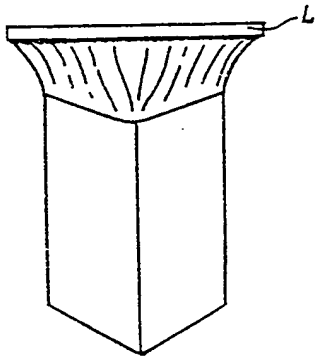


Fig. 9



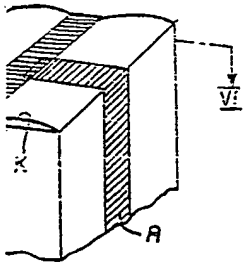
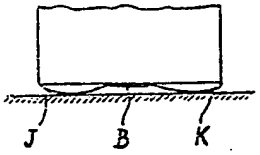


Fig. 8



957487 COMPLETE SPECIFICATION
3 SHEETS *This drowing is a reproduction of the Original on a reduced scale*
Sheets 2 & 3

Fig. 4

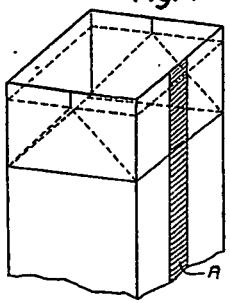


Fig. 5

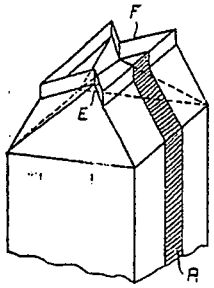


Fig. 6

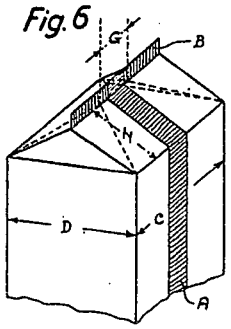


Fig. 9

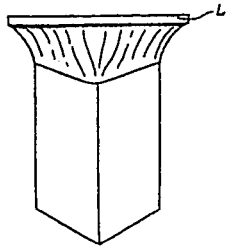


Fig. 7

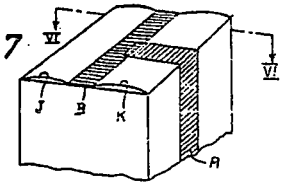


Fig. 8